

# Claims

- [c1] 1. An apparatus for interrupting an electrical short circuit current in an electrical distribution system having a plurality of phases, the apparatus comprising:
- a housing;
  - a plurality of separable conduction paths;
  - an operating mechanism in operable communication with the plurality of conduction paths;
  - an electronic trip unit in signal communication with each of the plurality of conduction paths and in operable communication with the operating mechanism; and
  - an electromagnetic trip unit in signal communication with each of the plurality of conduction paths and in operable communication with the operating mechanism;
- wherein the electromagnetic trip unit is configured to be operably responsive to a first half-cycle waveform of the short circuit current prior to the electronic trip unit being operably responsive to a second multi-cycle waveform of the short circuit current.
- [c2] 2. The apparatus of Claim 1, wherein:
- the electromagnetic trip unit comprises a magnetic actuator disposed at, and in signal communication with, each

of the plurality of conduction paths such that each magnetic actuator is individually in operable communication with the operating mechanism.

- [c3] 3.The apparatus of Claim 2, wherein:  
the electronic trip unit comprises a current sensor disposed at, and in signal communication with, each of the plurality of conduction paths.
- [c4] 4.The apparatus of Claim 3, wherein:  
the current sensor comprises a current transformer.
- [c5] 5.The apparatus of Claim 2, wherein:  
the electromagnetic trip unit comprises a magnetic yoke and a magnetic armature.
- [c6] 6.The apparatus of Claim 1, wherein:  
the plurality of conduction paths comprises a double-break contact structure.
- [c7] 7.The apparatus of Claim 1, wherein:  
the plurality of conduction paths comprises a blow open contact arm structure.
- [c8] 8.The apparatus of Claim 7, wherein:  
the blow open contact arm structure is configured to be operably responsive to the first half-cycle waveform of the short circuit current.

- [c9] 9.The apparatus of Claim 8, wherein:  
the blow open contact arm structure comprises a rotary contact bridge.
- [c10] 10.The apparatus of Claim 1, wherein:  
the plurality of conduction paths comprises a conduction path in each of three phases within the housing.
- [c11] 11.The apparatus of Claim 10, wherein:  
the electromagnetic trip unit comprises a single trip bar that is common to all of the three phases within the housing, each phase of the trip bar having a separate magnetic armature disposed thereat.
- [c12] 12.The apparatus of Claim 1, wherein:  
the electronic trip unit is configured to trip the operating mechanism at a lower trip threshold than the electromagnetic trip unit is configured to trip the operating mechanism.
- [c13] 13.A method of interrupting an electrical short circuit current in an electrical distribution system having a plurality of phases, comprising:  
sensing the electrical short circuit current at an electronic trip unit in signal communication with each of a plurality of conduction paths and in operable communication with an operating mechanism;

sensing the electrical short circuit current at an electromagnetic trip unit in signal communication with each of the plurality of conduction paths and in operable communication with the operating mechanism;  
in response to a first half-cycle waveform of the electrical short circuit at the electromagnetic trip unit, tripping a circuit breaker to interrupt the electrical short circuit current therethrough;  
wherein the electromagnetic trip unit is configured to be operably responsive to the first half-cycle waveform of the short circuit current prior to the electronic trip unit being operably responsive to a second multi-cycle waveform of the short circuit current.

[c14] 14.The method of Claim 13, wherein the tripping a circuit breaker comprises tripping an operating mechanism in operable communication with a plurality of separable conduction paths.

[c15] 15.The method of Claim 13, wherein the tripping a circuit breaker comprises:  
tripping a magnetic actuator disposed at, and in signal communication with, each of the plurality of conduction paths such that each magnetic actuator is individually in operable communication with the operating mechanism.

[c16] 16.The method of Claim 13, further comprising:

blowing open a contact arm structure of the plurality of conduction paths in response to the first half-cycle waveform of the short circuit current.

[c17] 17.The method of Claim 13, wherein the electronic trip unit is configured to trip the operating mechanism at a lower trip threshold than the electromagnetic trip unit is configured to trip the operating mechanism.

[c18] 18.An electronic circuit breaker having a plurality of separable conduction paths and an operating mechanism in operable communication with the plurality of conduction paths, the circuit breaker comprising:  
an electronic trip unit in signal communication with each of the plurality of conduction paths and in operable communication with the operating mechanism; and  
an electromagnetic trip unit in signal communication with each of the plurality of conduction paths and in operable communication with the operating mechanism;  
wherein the electromagnetic trip unit is configured to be operably responsive to a first half-cycle waveform of the short circuit current prior to the electronic trip unit being operably responsive to a second multi-cycle waveform of the short circuit current.

[c19] 19.The circuit breaker of Claim 18, wherein:  
the electromagnetic trip unit comprises a magnetic actu-

ator disposed at, and in signal communication with, each of the plurality of conduction paths such that each magnetic actuator is individually in operable communication with the operating mechanism; and  
the electronic trip unit comprises a current sensor disposed at, and in signal communication with, each of the plurality of conduction paths.

[c20] 20.The circuit breaker of Claim 19, wherein:  
the current sensor comprises a current transformer; and  
the electromagnetic trip unit comprises a magnetic yoke and a magnetic armature.

[c21] 21.The circuit breaker of Claim 18, wherein:  
the electronic trip unit is configured to trip the operating mechanism at a lower trip threshold than the electromagnetic trip unit is configured to trip the operating mechanism.

[c22] 22.The circuit breaker of Claim 18, wherein:  
the plurality of conduction paths comprises a double-break blow open contact arm structure; and  
the blow open contact arm structure is configured to be operably responsive to the first half-cycle waveform of the short circuit current.

[c23] 23.The circuit breaker of Claim 21, wherein:

the circuit breaker comprises at least a two-pole circuit breaker; and

the electromagnetic trip unit comprises a single trip bar common to all phases wherein each phase of the trip bar has a separate magnetic armature disposed thereat.